

# CALCULATION REPORT

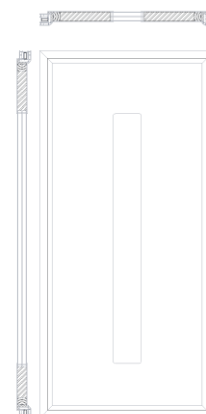
## THERMAL TRANSMITTANCE DOORSET



APPLICANT	<b>PROFILE DEVELOPMENTS</b> <b>Ballygiltenan North, Glin, Co. Limerick</b> <b>V94-K220 – GLIN (LIMERICK, IRELAND)</b>
MANUFACTURER <sup>(1)</sup>	<b>PROFILE DEVELOPMENTS</b>
PRODUCT	<b>SINGLE-LEAF HINGED DOOR</b>
REFERENCE <sup>(1)</sup>	<b>AVANTGARDE GLAZED</b>
MATERIAL <sup>(1)</sup>	<b>HPL, XPS insulation</b> <b>Glazing 4low/22 Ar / 4 / 22 Ar / 4</b> <b>Spacer: THERMOBAR</b>
DIMENSION	<b>2231 mm x 1066 mm (Hight x Width)</b>
DATE OF TEST	<b>07.02.2024</b>
DATE OF ISSUE	<b>07.02.2024</b>

**Calculation Standard :**  
UNE-EN ISO 10077-2 :2020.  
Thermal performance of windows,  
doors and shutters - Calculation of  
thermal transmittance - Part 2:  
Numerical method for frames (ISO  
10077-2:2017)  
UNE-EN ISO 10077-1 :2020.  
Thermal performance of windows,  
doors and shutters - Calculation of  
thermal transmittance - Part 1:  
General (ISO 10077-1:2017,  
Corrected version 2020-02).

**Section**



**RESULTADOS**       **$U_D = 0,83 \text{ W/m}^2\text{K}$**   
*Results*

**Luis García Viguera**  
*Department Director*



The result of the present test(s) only concerns the tested object(s). The reports signed electronically on digital support are considered an original document, as well as the electronic copies of the same. Their printing on paper has no legal validity (1) ENSATEC, S.L.U., declines all responsibility for the information provided by the client.



## 1 SCOPE

The purpose of this report is to determine the thermal transmittance of the following element: **Single-leaf hinged door, HPL and xps insulation, glazed** referenced by the customer as: **AVANTGARDE GLAZED**, by the numerical method described in the UNE-EN ISO 10077-1:2020 standard.

The simulation uses the BISCO software version 12, developed by the company Physibel, based on the two-dimensional finite element method for calculating heat transfer. This software has been validated in accordance with the specifications of the UNE-EN ISO 10077-2:2020 standard.

## 2 SAMPLE DESCRIPTION PROVIDED BY THE CLIENT

Description:	SOLID DOORSET
Model (1):	AVANTGARDE GLAZED
Material (1):	HPL, XPS INSULATED

The technical specifications of the test sample have been provided by the applicant and delivered to the laboratory under reference MV76222

The dimensions of the calculated elements are 2191 mm x 1006 mm (Hight x Width)

## 3 PROCEDIMIENTO DE CÁLCULO

The UNE-EN ISO 10077-1:2020 standard establishes that the thermal transmittance of the door is calculated using the following expression:

$$U_D = \frac{\sum A_g \cdot U_g + \sum A_p \cdot U_p + \sum A_f \cdot U_f + \sum l_g \cdot \Psi_g + \sum l_p \cdot \Psi_p}{\sum A_g + \sum A_f + \sum A_p}$$

$U_D$	Thermal transmittance of the door
$U_g$	Thermal transmittance of glazing
$U_f$	Thermal transmittance of frame
$U_p$	Thermal transmittance of opaque panel
$\Psi_g$	Linear thermal transmittance due to the combined thermal effects of infill, glazing and frame
$\Psi_p$	Linear thermal transmittance due to the combined thermal effects of the panel and frame
$A_g$	Area of glazing
$A_f$	Projected area of frame
$A_p$	Area of opaque panel
$l_g$	Total visible perimeter of glazing
$l_p$	Total visible perimeter of opaque panel

The values corresponding to the heat transmission coefficients of the frames  $U_f$ , and of the opaque panel  $U_p$  have been calculated numerically according to UNE-EN ISO 10077-2:2020. These calculations are shown in section 5 of this report.



The value of  $U_g$  has been estimated by the laboratory according to EN 634 and the description of the insulating glass unit, provided by the petitioner.

- Total thickness of IGU: 56 mm
- Composition 4mm Low e glass/ 22mm spacer+Argon/4mm clear float glass/22mm spacer+Argon/4mm clear glass
- $U_g$  Value = 0.50 W/m<sup>2</sup>K

Linear thermal transmission coefficient  $\Psi_g$  It takes into account combined thermal effects of glazing, spacer and frame, provided by the applicant, in the THERMOBAR spacer data sheet. See annex 8 for the technical data sheets of the materials provided by the applicant.

Linear thermal transmission coefficient  $\Psi_p$  can be considered zero as the requirements of section 6.3.2.5. of UNE-EN ISO 10077-1:2020 are fulfilled.

#### 4 BOUNDARY CONDITIONS AND MATERIAL PARAMETERS.

The boundary conditions used for the calculation are those described in Annex E of UNE-EN ISO 10077-2:2020.

Position	Exterior Rse (m <sup>2</sup> K/W)	Interior Rsi (m <sup>2</sup> K/W)
Normal (flat surface)	0.04	0.13
Radiation/Reduced convection (edges or joints between surfaces)	0.04	0.20

Reference temperature conditions are 20°C inside and 0°C outside.

The emissivity shall be taken as 0,9 in all cavities.

Thickness of simulated glass, 40 mm

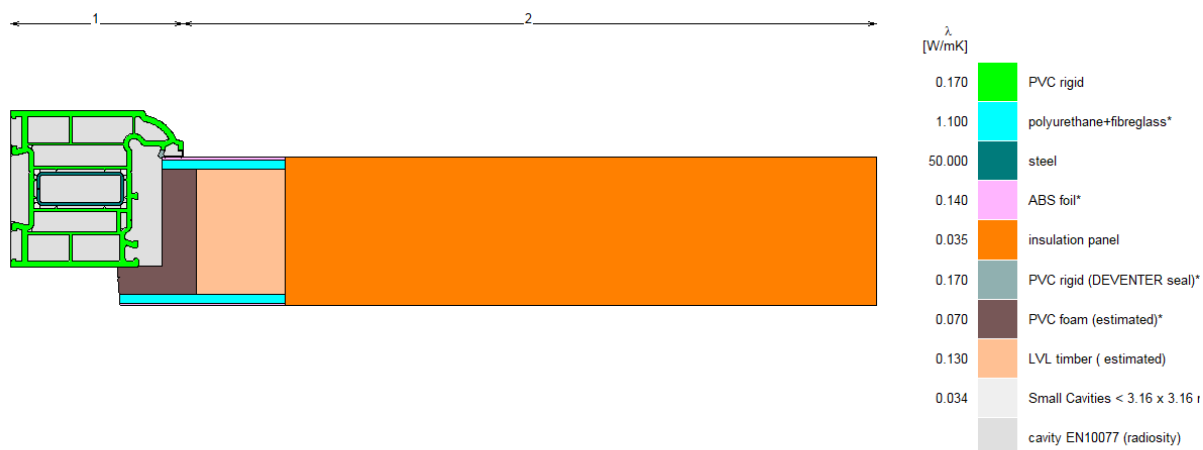
The calculation method used was the RADIOSITY

The thermal conductivity values of the materials used in the calculation are taken from the UNE-EN ISO 10456:2012 Standard "Building materials and products. Hygrothermal properties. Tabulated design values", except those marked with (\*) which have been provided by the applicant.



## 5 CALCULATION OF THE THERMAL TRANSMITTANCE OF THE ELEMENTS

### 5.1 Thermal transmittance Outer frame.



#### Boundary conditions

The boundary conditions are represented below

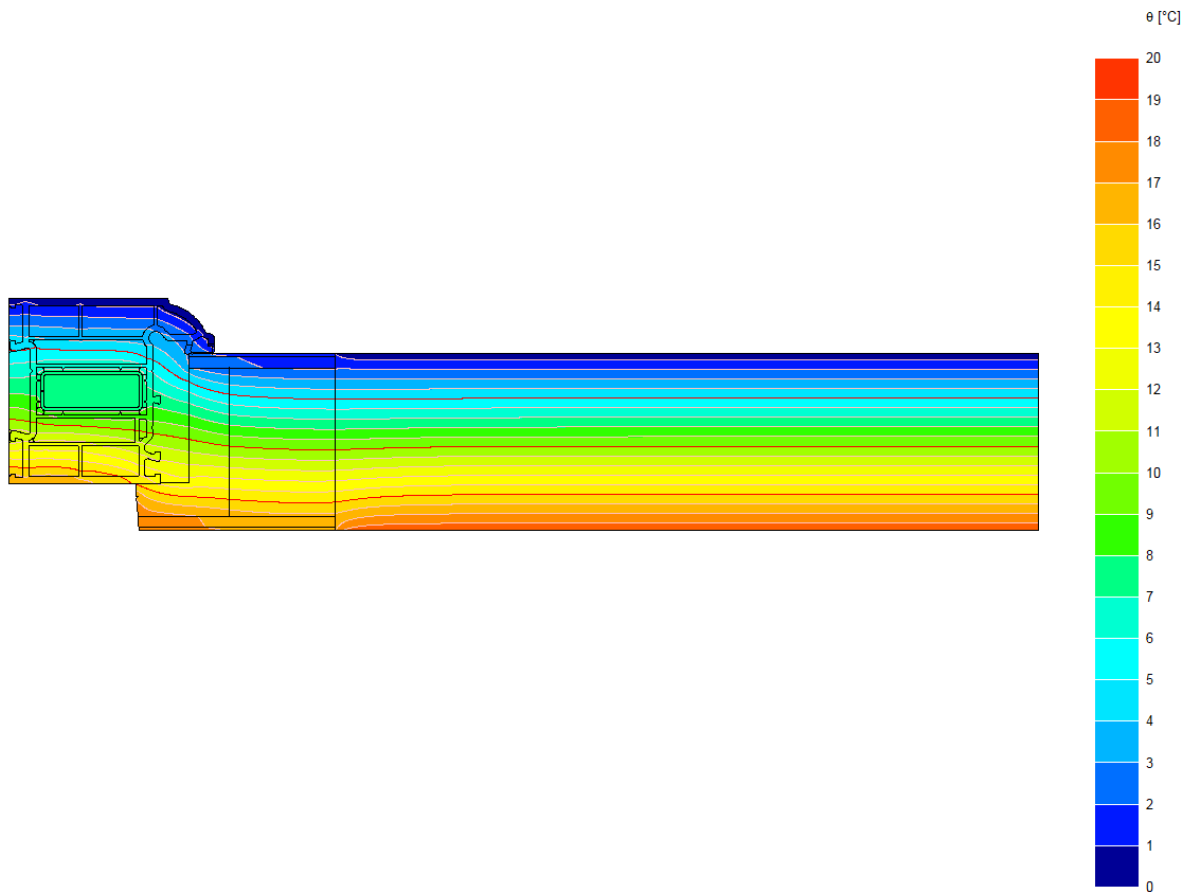


Total Heat Flow (Q)	5,835	W/m
Panel length (l <sub>p1</sub> )	0,311	m
Frame length (l <sub>f</sub> )	0,077	m
Thermal transmittance Panel (U <sub>p1</sub> )	0,483	W/m²K
<b>Thermal transmittance (U<sub>f</sub>)</b>	<b>1,838</b>	<b>W/m²K</b>

$$U_f = \frac{\left(\frac{Q}{t_i - t_e}\right) - U_{p1} \cdot l_{p1}}{l_f}$$

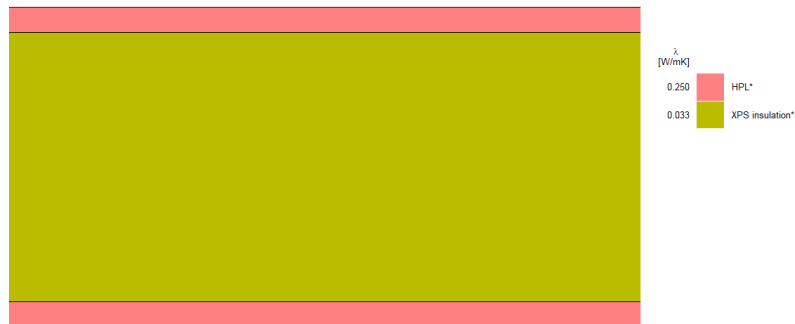


### Isotherms and heat flux graph

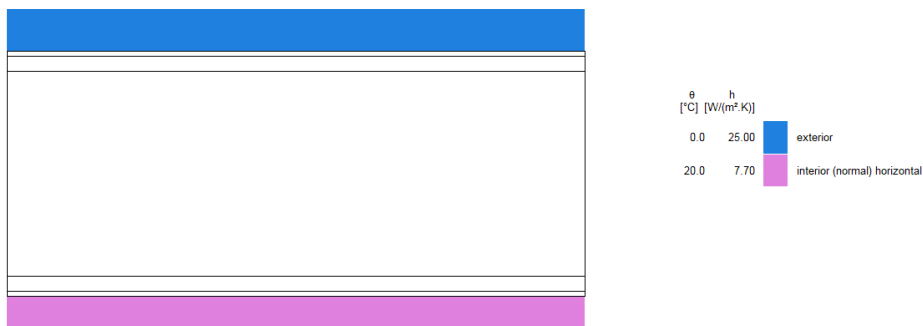




## 5.2 Thermal transmittance flat panel.



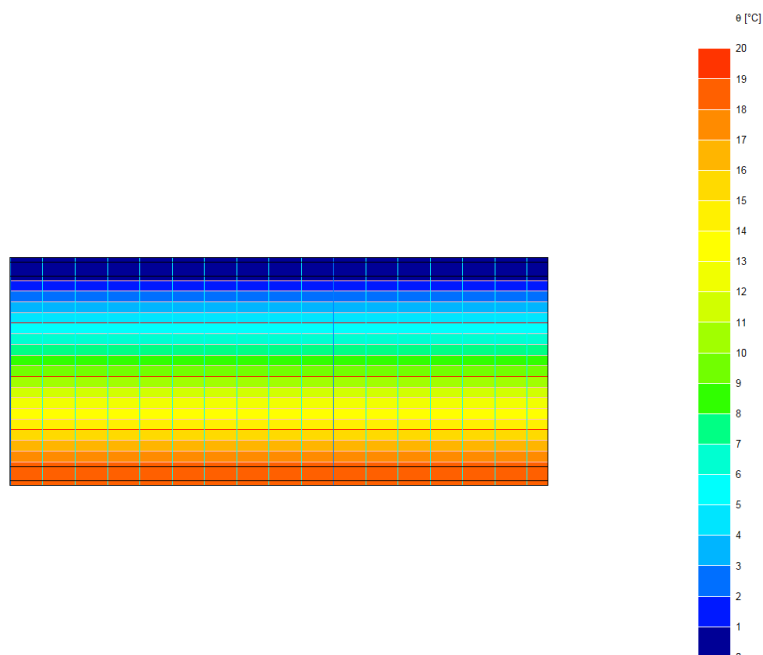
### Boundary conditions

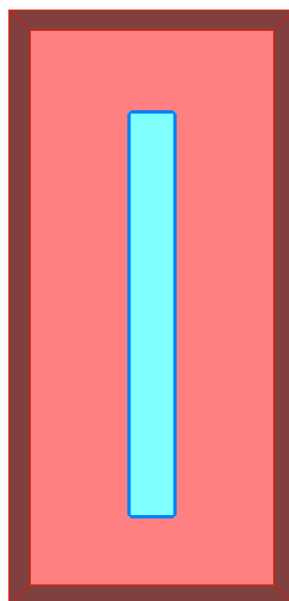


Total Heat Flow (Q)	1,652	W/m
Panel length ( $l_{p1}$ )	0,1575	m
<b>Thermal transmittance (<math>U_p</math>)</b>	<b>0,525</b>	<b>W/m²K</b>

$$U_p = \frac{Q}{(t_i - t_e) \cdot l_p}$$

### Isotherms and heat flux graph.



**6 CALCULATION OF THERMAL TRANSMITTANCE OF THE DOOR**

Width	1066	mm
Height	2231	mm
Total Area	2.3782	m <sup>2</sup>
U*A total	1.8777	W/K
ψ*L total	0.1006	W/K
<b>Transmittance U<sub>D</sub></b>	<b>0.8318</b>	<b>W/m<sup>2</sup>K</b>

The expanded uncertainty for the calculation of thermal transmittance is less than 5%

NOTE: The uncertainty has been calculated taking into account what is indicated in the EN UNE-EN ISO 10077-2:2020 standard.

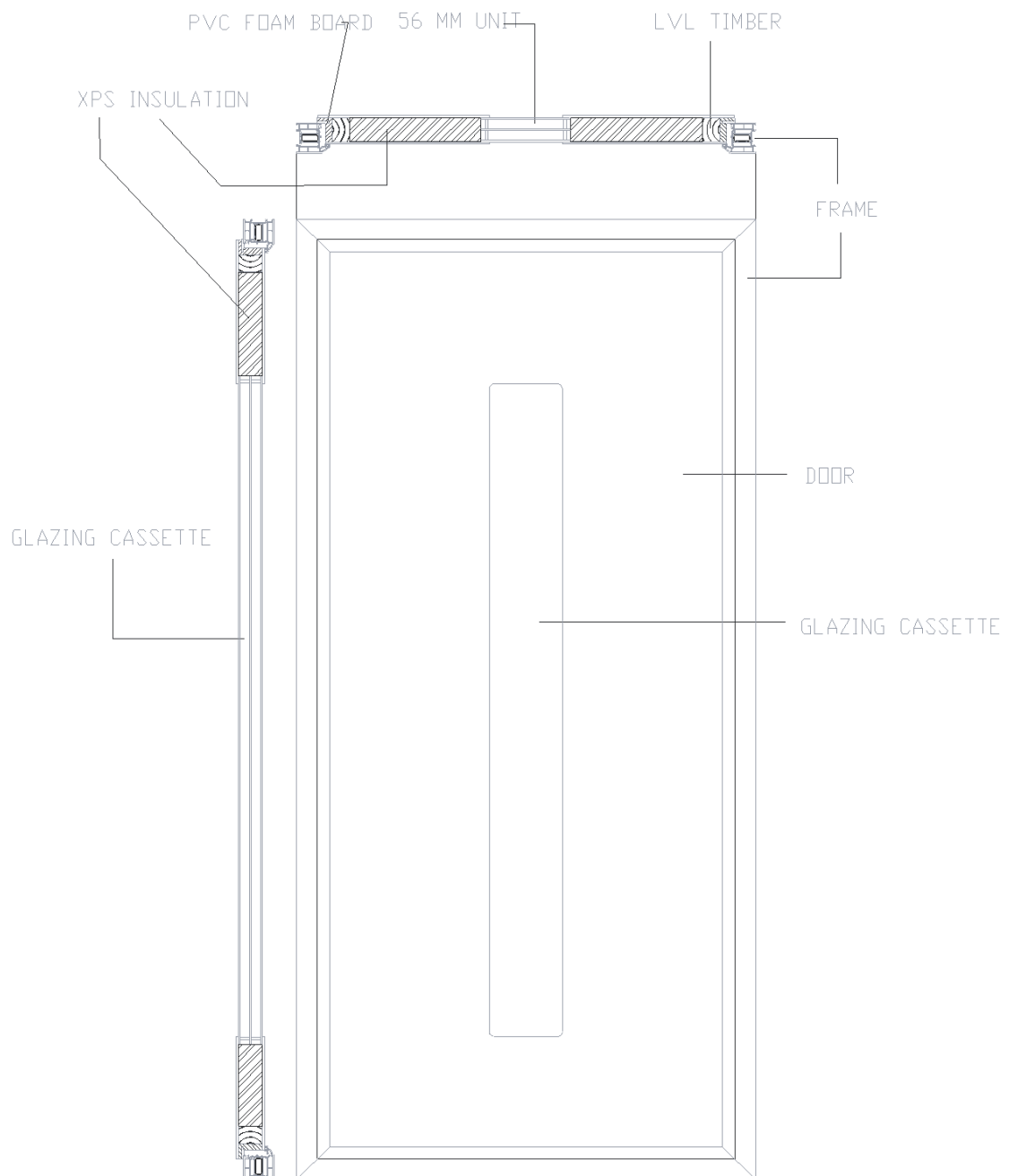
The individual values for each element are shown below:

<i>Reference</i>	<i>color</i>	<i>U [W/m<sup>2</sup>K]</i>	<i>Width [mm]</i>	<i>Height [mm]</i>	<i>A [m<sup>2</sup>]</i>	<i>U*A [W/K]</i>
glazing		0,50	170	1515	0,25746	0,1287
flat_panel		0,5250	912	2077	1.63676	0,8593
outer_frame		1,838	1066	77	0,07615	0,1400
outer_frame		1,838	77	2231	0,16586	0,3048
outer_frame		1,838	77	2231	0,16586	0,3048
outer_frame		1,838	1066	77	0,07615	0,1400

<i>ψ material</i>	<i>color</i>	<i>ψ [W/mK]</i>	<i>Total length L [mm]</i>	<i>ψ*L [W/K]</i>
thermobar		0,030	3352,83	0,1006



7 SECTIONS PROVIDED BY THE CUSTOMER <sup>(1)</sup>







8 DOCUMENTATION PROVIDED BY THE CUSTOMER (1)



The Thermobar™ range is the result of 40 years of dedication to insulated glass.

phA advanced component



**Thermobar**  
Warm Edge Spacer Tube  
Available in black, grey or white

- SAVE energy with Lowest Conductivity Spacers - 0.14W/mK
- SAVE energy with lowest Psi values
- SAVE energy with reduced overall window U-values
- SAVE costs on the best futureproof window components

	Plastic window frame	Wood window frame
Double Glazing	0.032	0.031
Triple Glazing	0.030	0.029

Lower Psi values available with Hot Melt.

[www.thermobarwarmedge.com](http://www.thermobarwarmedge.com)



**Thermobar**™  
Warm Edge Spacer Tube

For further information on specifying Thermobar in various window types contact Thermoseal Group on: 0845 331 3950, International: +44 (0)121 331 3950

THERMOBAR - Thermal performance in various window types						
Spacer System	DOUBLE GLAZING			TRIPLE GLAZING		
	Aluminium	Stainless Steel	Thermobar	Aluminium	Stainless Steel	Thermobar
<b>WOODEN WINDOWS:</b>	Frame value: U <sub>f</sub> =1.4 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =1.1 W/m <sup>2</sup> K			Frame value: U <sub>f</sub> =1.3 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =0.7 W/m <sup>2</sup> K		
Psi value [W/mK]	0.082	0.053	0.031	0.089	0.054	0.029
Window, U <sub>w</sub> 1-pane [W/m <sup>2</sup> K]	1.40	1.32	1.27	1.10	1.02	0.95
Window, U <sub>w</sub> 2-pane [W/m <sup>2</sup> K]	1.52	1.41	1.33	1.26	1.13	1.04
Minimal surface temperature* [°C]	4.1	7.3	9.7	6	9.6	12.1
<b>PVC WINDOWS:</b>	Frame value: U <sub>f</sub> =1.2 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =1.1 W/m <sup>2</sup> K			Frame value: U <sub>f</sub> =1.2 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =0.7 W/m <sup>2</sup> K		
Psi value [W/mK]	0.076	0.051	0.032	0.078	0.050	0.030
Window, U <sub>w</sub> 1-pane [W/m <sup>2</sup> K]	1.32	1.26	1.21	1.05	0.98	0.93
Window, U <sub>w</sub> 2-pane [W/m <sup>2</sup> K]	1.42	1.33	1.26	1.19	1.08	1.01
Minimal surface temperature* [°C]	5.3	8.3	10.4	6.7	9.9	12.0
<b>WOOD ALUMINIUM WINDOWS:</b>	Frame value: U <sub>f</sub> =1.4 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =1.1 W/m <sup>2</sup> K			Frame value: U <sub>f</sub> =1.4 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =0.7 W/m <sup>2</sup> K		
Psi value [W/mK]	0.094	0.059	0.032	0.100	0.060	0.030
Window, U <sub>w</sub> 1-pane [W/m <sup>2</sup> K]	1.43	1.34	1.28	1.17	1.08	1.00
Window, U <sub>w</sub> 2-pane [W/m <sup>2</sup> K]	1.57	1.44	1.34	1.35	1.21	1.10
Minimal surface temperature* [°C]	2.2	6.1	8.8	4.4	8.6	11.3
<b>ALUMINIUM WINDOWS:</b>	Frame value: U <sub>f</sub> =1.6 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =1.1 W/m <sup>2</sup> K			Frame value: U <sub>f</sub> =1.6 W/m <sup>2</sup> K; Glass value: U <sub>g</sub> =0.7 W/m <sup>2</sup> K		
Psi value [W/mK]	0.110	0.068	0.036	0.120	0.064	0.031
Window, U <sub>w</sub> 1-pane [W/m <sup>2</sup> K]	1.54	1.44	1.36	1.30	1.17	1.09
Window, U <sub>w</sub> 2-pane [W/m <sup>2</sup> K]	1.72	1.56	1.45	1.53	1.32	1.21
Minimal surface temperature* [°C]	4.7	8.4	10.8	6.8	10.6	12.9

The equivalent heat conductivity was calculated as per the ift WA-17/1 guidelines. The representative Psi values were calculated under the conditions laid down in the ift WA-08/2 guidelines.

Psi value: linear heat throughput at edge of glass [W/mK] as per EN ISO 10077-2:2012-06

\* corresponds to conditions in DIN 4108-3

External temperature T<sub>a</sub>: -10°C  
Internal temperature T<sub>i</sub>: +20°C

Geometry	Wood	PVC	Wood-Aluminium	Aluminium
Total Area: (1.23 x 1.48m) A <sub>w</sub> in m <sup>2</sup>	1.82	1.82	1.82	1.82
Frame width b <sub>f</sub> in mm:	110	117	120	130
Frame area A <sub>f</sub> in m <sup>2</sup> (1-pane/2-pane)	0.548/0.686	0.579/0.725	0.593/0.742	0.637/0.796
Length of glass edge l <sub>g</sub> in m (1-pane/2-pane)	4.540/6.840	4.484/6.742	4.460/6.700	4.380/6.560



## PRODUCT DATA

Date: October 2009

Code: 00814/30

# BOSTIK 5000 HOT MELT BUTYL

## HOT MELT INSULATING GLASS SEALANT

Bostik 5000 Hot Melt Butyl Sealant has been specifically formulated for use in the production of insulating glass units. Bostik 5000 Hot Melt Butyl Sealant is a single part butyl rubber based sealant which, when applied at the correct temperature, sets quickly from its molten state allowing units to be moved from their assembly location between two and five minutes after application. Units can therefore be sealed and glazed within the same day. Bostik 5000 Hot Melt Butyl Sealant has a high output and fast heat loss enabling optimum turn round of unit production. The combination of these properties also means that corner defects can be easily avoided thereby ensuring a complete seal around the unit.

### Features

- Compatible with all types of manual dispensing equipment currently available
- Quick-setting from the molten state
- Clean application with no wastage
- No cleaning or purging of dispensing equipment required
- Can be used as a secondary seal in conjunction with a P.I.B. primary sealant such as Bostik 2000. Consult Bostik Technical Services
- Convenient pack sizes for easy storage

### Certification

Bostik 5000 fully meets the requirements of EN 1279.

### Product Characteristics

<b>Packaging</b>	6.5 kg block 190 kg drum
<b>Constitution</b>	A blend of butyl rubber with other synthetic polymers and resins, which contain no volatile materials
<b>Colour</b>	Black
<b>Form</b>	Rubbery solid
<b>Density</b>	1.15 to 1.19 g/cm <sup>3</sup>
<b>Shelf life/storage</b>	At least 12 months from date of manufacture when stored unopened in a cool, dry place within the temperature range +5°C to +25°C.

### Typical Performance Data (approx.)

<b>Moisture vapour transmission rate</b>	0.1 g/m <sup>2</sup> per day for a 2mm film at 25°C, 100% RH. (ASTM method E96)
<b>Application temperature</b>	+180°C to +195°C ex nozzle

### Directions for use

#### IMPORTANT

Before embarking on any work involving Bostik 5000 Hot Melt Butyl Sealant, the Safety Data sheet should be carefully studied by those carrying out the work. Gloves and eye protection are recommended.

#### Surface Preparation

Bostik 5000 Hot Melt Butyl Sealant exhibits excellent adhesion to cut, ground or polished glass, aluminium and galvanised steel spacer bar. It is essential that all surfaces are clean and dry and free from foreign matter. Coated glasses which require edge de-glazing must be used in accordance with manufacturer's instructions.

#### Application

The sealant should be applied by means of a suitable heated dispenser. It is very important that the sealant is applied within the recommended temperature range, therefore it is advisable that the application temperature be checked daily with a digital thermometer at the gun nozzle whilst gunning sealant. Further advice can be obtained from the Bostik Technical Service Department. The sealant should be applied into the cavity of the insulating glass unit in such a manner that complete wetting of the glass and spacer occurs. If an internal locating nozzle is used, the nozzle should be checked regularly to avoid excessive wear. In order to ensure that the correct seal depth is maintained. Care should be taken on sealing each corner and the sealant should be pressed together whilst still molten by means of a silicone rubber pad, in order to prevent any holes or gaps in the sealant at the corners, which could lead to premature unit failure. If the units are to be stored on a rack ensure that they are adequately supported under both panes of glass.

#### Glazing Method

Units manufactured with Bostik 5000 Hot Melt Butyl should be glazed in accordance with the current G.G.F. (Glass and Glazing Federation) methods or other G.G.F. recognised and approved methods. Further information may be obtained from the Bostik Technical Service Department. The use of adhesive tape is not recommended to cover the edge of the unit. Drained and ventilated systems should be used where possible otherwise fully bedded glazing methods are necessary. If the unit is to be glazed using a glazing compound which is likely to be in contact with the edge seal

See final page for disclaimer.

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[www.bostik.co.uk](http://www.bostik.co.uk)

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# Kerto<sup>®</sup> LVL

## Q-panel



Kerto<sup>®</sup> LVL Q-panel is a load-bearing and dimensionally stable product that can be used in both horizontal and vertical structures. Q-panel can be used in the most demanding applications. Use of large Q-panel ensures material efficiency and minimizes installation time.

Kerto LVL Q-panel is made of 3 mm thick strength graded softwood veneers of which approximately 20 % are oriented in crosswise direction. The veneers are bonded with weather- and boil-resistant phenol formaldehyde adhesive. Q-panel has outstanding strength-to-weight ratio. Crosswise veneers ensure excellent dimensional stability and enhance the transverse strength and stiffness of the panel.

Q-panel is an ideal material for load-bearing applications including floor, wall and roof elements due to its stiffness, strength properties and light weight. It can be used in both horizontal and vertical applications.

### Applications

#### Structural applications:

- Panel product for roof, floor and wall constructions
- High and slender beams
- Headers and lintels
- Portal frames

#### Industrial applications:

- Free shaped beams and panels (CNC machining)
- Components for prefabricated roof, floor and wall elements and modules
- Doors and windows
- Concrete formwork

### Major advantages

- Strong and rigid
- Excellent strength-to-weight ratio
- Dimensional stability improved against warp and twist
- Great workability and quick to install
- Easy to fasten, nail and drill
- Ensures material efficiency with customised product dimensions
- High and slender beams for energy efficient constructions
- Large panels up to 2,500 mm wide, 20 m long
- Easy to design with free Finnwood software
- Made of sustainable northern wood and PEFC certified
- Kerto LVL (1 m<sup>3</sup>) contains the stored carbon equivalent to 794 kg CO<sub>2</sub>







# ASD Interior Compact

## Technical Data Sheet

Properties	Test Method	Property or Attribute	Unit (max or min)	Values	
				CGS	CGF
<b>SURFACE QUALITY</b>					
Surface Quality	EN 438-4	Spots, dirt and similar surface defects	mm <sup>2</sup> /m <sup>2</sup>	≤1	
		Fibres, hairs and scratches	mm/m <sup>2</sup>	≤10	
<b>DIMENSIONAL TOLERANCES</b>					
Dimensional Tolerances	EN 438-25	Thickness tolerance	mm	2,0st<3,0: +/-0,20	
				3,0st<5,0: +/-0,30	
				5,0st<8,0: +/-0,40	
				8,0st<12,0: +/-0,50	
				12,0st<16,0: +/-0,60	
				16,0st<20,0: +/-0,70	
				20,0st<25,0<25,0: +/-0,80	
	EN 438-26	Length and width	mm	+10/-0	
	EN 438-27	Straightness of edges	mm/m	≤1,5	
	EN 438-28	Squareness	mm/m	≤1,5	
	EN 438-29	Flatness	mm/m	2,0st<6,0: ≤8,0	
			mm/m	6,0st<10: ≤5,0	
			mm/m	10,0st ≤ 3,0	
<b>GENERAL PROPERTIES</b>					
Resistance to surface wear	EN 438-210	Initial Point	Revolucion	≥ 150	
		Wear Value	Revolucion	≥ 350	
Resistance to immersion in boiling water	EN 438-212	Mass increase - 2st<5	%	5,0	7,0
		Mass increase t≥5	%	2,0	3,0
		Thickness increase 2st<5	%	6,0	9,0
		Thickness increase t≥5	%	2,0	6,0
		Appearance-Gloss Finish	Rating (min)	3	
Resistance to water vapor	EN 438-214	Appearance-Other Finish	Rating (min)	4	
		Appearance-Gloss Finish	Rating (min)	3	
Resistance to dry heat (160°C)	EN 438-216	Appearance-Other Finish	Rating (min)	4	
		Appearance-Gloss Finish	Rating (min)	3	
		Appearance-Other Finish	Rating (min)	3	
		Appearance-Other Finish	Rating (min)	4	
Resistance to wet heat (100°C)	EN 438-218	Appearance-Gloss Finish	Rating (min)	3	
		Appearance-Other Finish	Rating (min)	4	
Dimensional stability at elevated temperature	EN 438-217	Cumulative dimensional change 2st<5 mm	Longitudinal (%)	≤ 0,40	
		Cumulative dimensional change 2st<5 mm	Transversal (%)	≤ 0,80	
		Cumulative dimensional change 5 mm ≤ t	Longitudinal (%)	≤ 0,30	
		Cumulative dimensional change 5 mm ≤ t	Transversal (%)	≤ 0,60	
Resistance to impact with large diameter ball	EN 438-2.21	Indentation diameter 2st<6	mm	h 1400*/ d≤10**	
		Indentation diameter t≥6	mm	h 1800*/ d≤10**	
Resistance to crazing (20 hrs at 80°C)	EN 438-224	Appearance	Rating (min)	4	
Resistance to scratching	EN 438-225	Appearance- Smooth finish	Rating (min)	2	
		Appearance- Textured finish	Rating (min)	3	
Resistance to staining	EN 438-226	Appearance- Group 1&2	Rating (min)	5	
		Appearance- Group 3	Rating (min)	4	
Light fastness (Xenon-arc)	EN 438-227	Contrast	Grey scale rating	4	
Flexural modulus	EN ISO 178	Stress	Mpa (min)	9000	
Flexural strength	EN ISO 178	Stress	Mpa (min)	80	
Tensile strength	EN ISO 527-2	Stress	Mpa (min)	60	
Density	EN ISO 1183	Density	g / cm3 (min)	1,35	
Reaction to fire / CGS	EN 13823	Classification t: 6 mm - 10 mm	Classification	D-s2,d0	
Reaction to fire / CGF	EN 13823	Classification (t: 6 mm)	Classification	B-s1,d0	
Formaldehyde emission (6mm)	EN 717-1	Gas analysis	mg/(m <sup>2</sup> *h)	0,03	
		Classification	Rating	E1	

\* h: Drop Height  
\*\*d: Indentation Diameter